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A new species of *Stiphropus* (Aranei: Thomisidae) from China and first documentation of myrmecophily in this genus

Новый вид пауков рода *Stiphropus* (Aranei: Thomisidae) из Китая и первое подтверждение мирмекофилии в этом роде

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КЛЮЧЕВЫЕ СЛОВА: Азия, Araneae, пауки-бокоходы, Stiphropodinae, биология, Гуандун.

ABSTRACT. *Stiphropus myrmecophilus* sp.n. is described from Southern China based on both sexes, and the ecology of the new species is also discussed. Myrmecophily in this genus is described for the first time.

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РЕЗЮМЕ. Описан новый вид пауков-бокоходов *Stiphropus myrmecophilus* sp.n. из Южного Китая. Обсуждается его биология. Впервые зарегистрирована мирмикофолия в роде *Stiphropus*.

Introduction

Stiphropus Gerstäcker, 1873 is a relatively small genus with 20 species, 12 of which are distributed in Africa and eight in Asia [WSC, 2019]. Studies of Asian *Stiphropus* spp. have mainly focused on species distributed in a limited region, except that of Ono [1980] who revised six species of the genus from Asia and summarized their distribution data. Studies of Chinese *Stiphropus* are very scarce, and only two species, *S. ocellatus* Thorell, 1887 (China: Guangxi, Myanmar and Vietnam) and *S. falciformus* Yang, Zhu et Song, 2006 (China: Yunnan), were known from China [WSC, 2019] prior to this study.

While surveying spiders from Guandong, we found a new species of *Stiphropus* that is closely allied with the ant species *Tetramorium insolens* (Smith, 1861). The goal of this paper is to provide a description of the new species and brief notes on its natural history.

Materials and methods

The materials examined for this study are deposited in the following institutions: BMNH — Natural History Museum, London, United Kingdom; IZCAS — Institute of Zoology, Chinese Academy of Sciences, Beijing, China; LPSNU — School of Biological Science and Technology, Liupanshui Normal University, Liupanshui, China; SNUC — Insect Collection of Shanghai Normal University, Shanghai, China.

Specimens were preserved in 80% alcohol. Examination, photography and measurements were performed using a Leica M205A stereomicroscope equipped with a Leica DFC550 camera and LAS software (Ver. 4.6). Male palp photomicroscopy images were taken with an Olympus C7070 zoom digital camera (7.1 megapixels). Photos were stacked with Helicon Focus (Version 6.7.1) and processed in Adobe Photoshop CC 2018. Eye sizes are measured as the maximum diameter from either the dorsal or frontal view. The terminology used in the text and figures follows Ono [1988]. Distribution maps were generated using ArcMap software (Version 10.4). All measurements are in millimeters.

Abbreviations used in the text as following: ALE — anterior lateral eye; AME — anterior median eye; CD — copulatory duct; CO — copulatory opening; DTA — dorsal tibial apophysis; E — embolus; FD — fertilization duct; MOA — median ocular area; PLE — posterior lateral eye; PME — posterior median eye; S — spermatheca; Tu — tutaculum; VTA — ventral tibial apophysis.

Taxonomy

Genus *Stiphropus* Gerstaecker 1873

Stiphropus myrmecophilus **sp.n.**
Figs 1A–D, F–J, 2A–I, 3.

TYPE MATERIAL. Holotype ♂ and allotype ♀ (IZCAS-Ar40350-Ar40351), CHINA: Guangdong Province, Maoming City, Huazhou County, Tongqing Town, Dacha Village, 21°36′05.5″N,

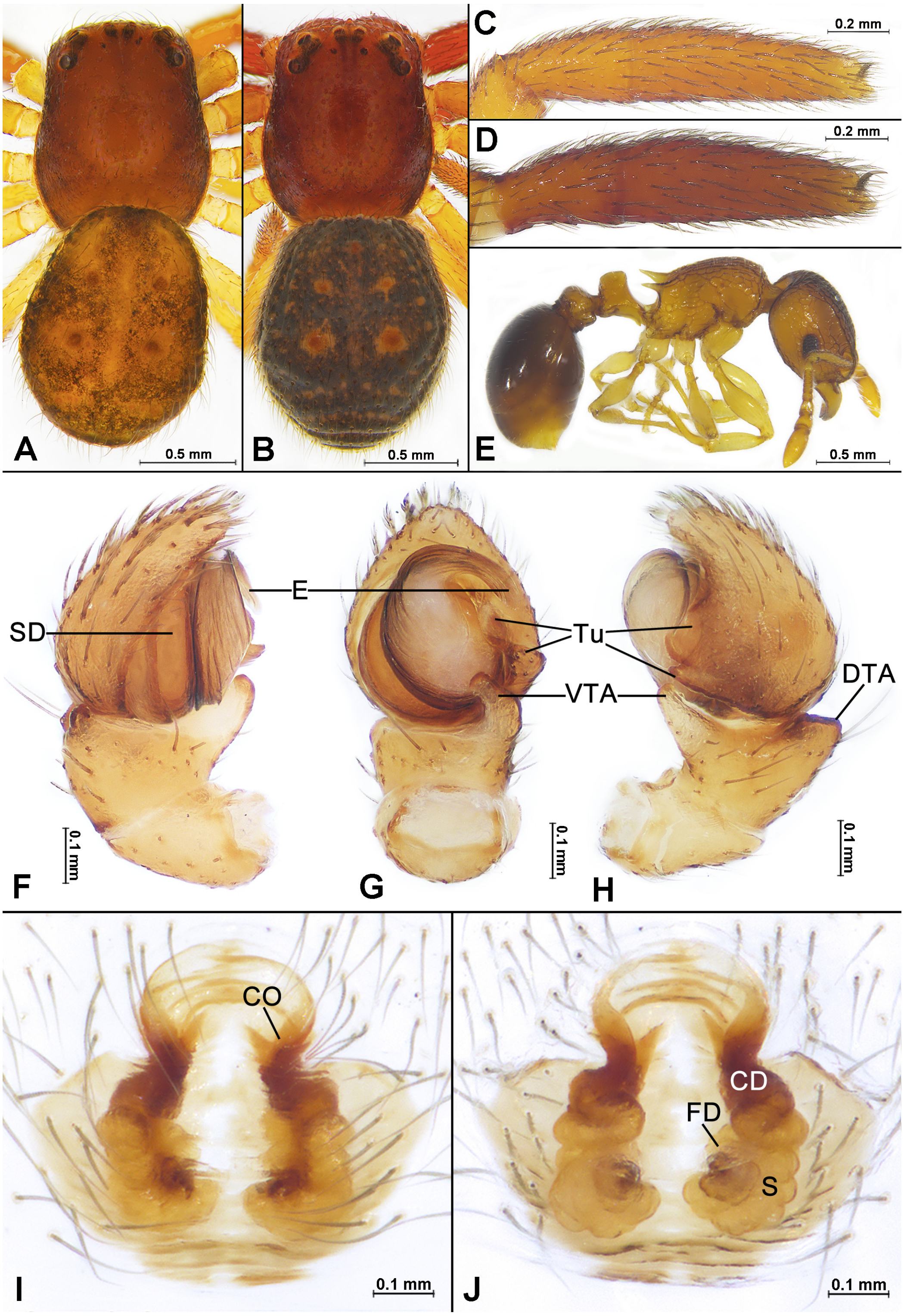


Fig. 1. *Stiphropus myrmecophilus* sp.n., holotype ♂ (A, C, F–H) and paratype ♀ (B, D, I–J). A–B —habitus, dorsal; C–D — metatarsus and tarsus of leg I; E — host ant *Tetramorium insolens*; F–H — left male palp, prolateral ventral and retrolateral; I–J — epigyne, ventral and dorsal. Abbreviations: CD — copulatory duct; CO — copulatory opening; DTA — dorsal tibial apophysis; E — embolus; FD — fertilization duct; S — spermatheca; Tu — tutaculum; VTA — ventral tibial apophysis.

Рис. 1. *Stiphropus myrmecophilus* sp.n., голотип ♂ (A, C, F–H) и паратип ♀ (B, D, I–J). A-B — габитус, сверху; C–D — предлапка и лапка I; E — муравей-хозяин *Tetramorium insolens*; F–H — пальпа самца, пролатерально, вентрально и ретролатерально; I–J — эпигина, снизу и сверху. Сокращения: CD — копулятивный канал; CO — копулятивное отверстие; DTA — дорзальный отросток голени; E — эмболюс; FD — оплодотворительный канал; S — рецептакула; Tu — тутакулюм; VTA — вентральный отросток голени.

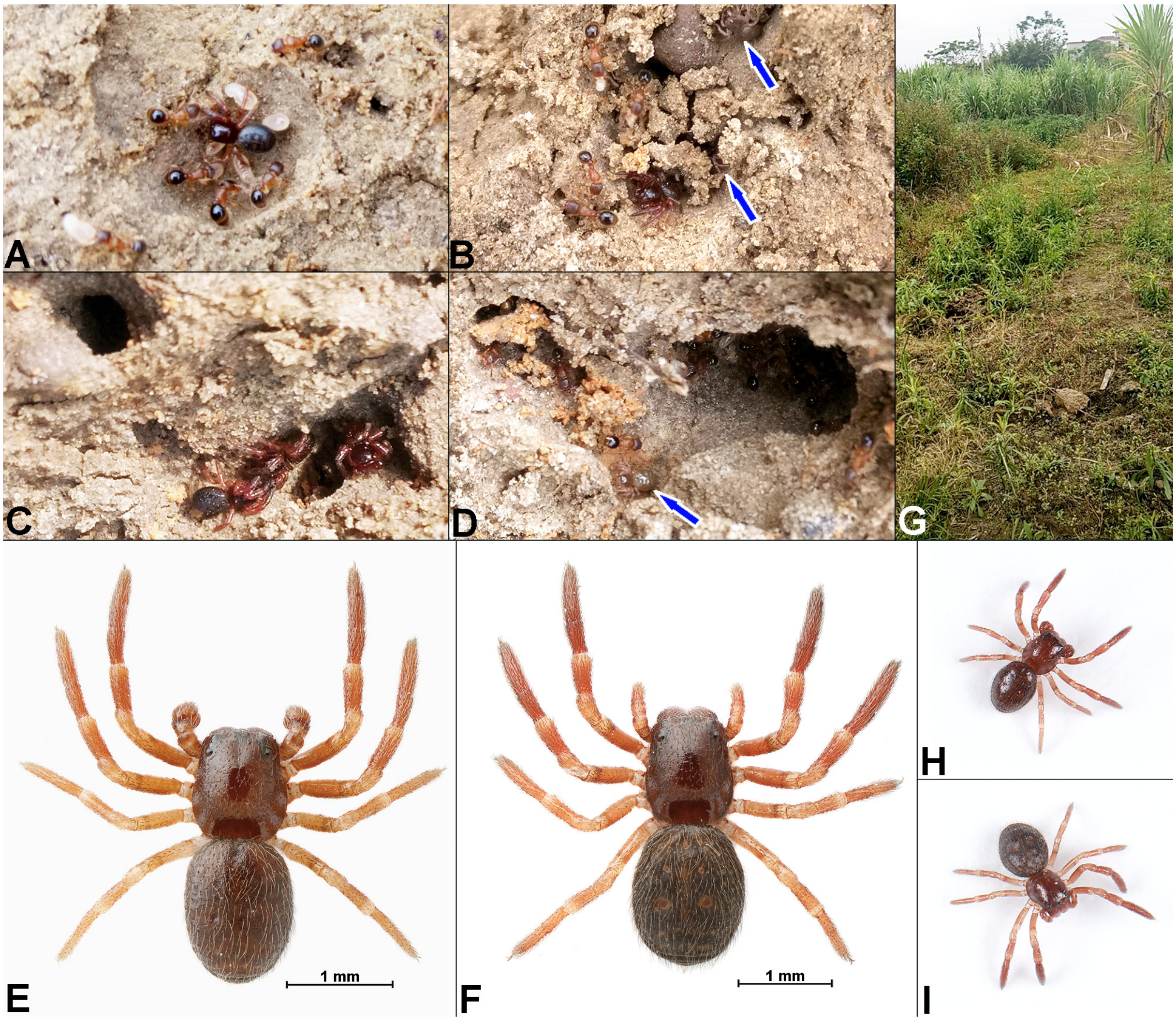


Fig. 2. *Stiphropus myrmecophilus* sp.n. A — female in the nursery of a *Tetramorium insolens* nest; B — adult (male) and juveniles (blue arrows) with associated ants; C — adult spiders living together in an ant nest; D — a juvenile (blue arrow) in an ant nest; E, H — live male; F, I — live female; G — habitat of type locality. (A–D, G photographed by Feng He; E–F photographed by Ri-Xin Jiang).

Рис. 2. *Stiphropus myrmecophilus* sp.n. A — самка в выводковой камере в гнезде *Tetramorium insolens*; B — самец и ювенильные особи (голубые стрелки) вместе с муравьём-хозяином; C — взрослые пауки живущие совместно в муравейнике; D — ювенильные пауки (голубая стрелка) в муравейнике; E, H — самец; F, I — самка; G — биотоп в котором собраны пауки; H (A–D, G фото Фен Хэ; E–F фото Жи-Синь Цзян).

110°39′51.1″E, 10 m, meadow, ant nest, 30.XII.2017, Feng He leg. Paratypes: 1 ♂ 1 ♀ (SNUC), 1♂ 3 ♀♀ (BMNH), 2 ♀ (LPSNU), same data as for holotype; 2 ♂♂ 6 ♀♀ (IZCAS-Ar40352-40359), same data as holotype, but 14.X.2017.

ETYMOLOGY. The specific name comes from Greek “*myrmeco*-” (ant) and “-*philus*” (beloved), refers to this species living in ant nests.

DIAGNOSIS. The new species is similar to *S. falciformus* Yang, Zhu et Song, 2006 by the shape of the ventral tibial apophysis and cymbium, as well as the location of the copulatory openings and the arrangement of the copulatory ducts in the epigyne. However, *S. myrmecophilus* sp.n. can be distinguished from *S. falciformus* by having the tip of the ventral tibial apophysis sub-truncated (Fig. 1G) (*vs*. rounded, fig. 1C in Yang *et al*. [2006]) and the distal half of the ventral tibial apophysis constricted (Fig. 1G) (*vs*. expanded, then constricted, fig. 1C in Yang *et al*. [2006]); the dorsal tibial apophysis is not strongly extended, but wide and sub-triangular distally (Fig. 1H) (*vs*. strongly extended, thin and spiniform distally, fig 1D in Yang *et al*. [2006]); cymbium with a sub-triangular tutaculum adjacent to flake-like tutaculum in retrolateral view (Figs 1H) (*vs*. sub-hooked, 1D in Yang *et al*. [2006]); the tip of embolus (Fig 1G) rounded (bevel in *S. falciformus*, fig 1C in Yang *et al*. [2006]). Vulva sub-oval (*vs*. sub-triangular, figs 2–3 in Li *et al*. [2009]); proximal parts of the copulatory ducts wide (compared to the space between the copulatory openings, figs 1I–1J) (*vs*. narrow, figs 2–3 in Li *et al*. [2009]); the wrinkled anterior hood narrow (compared to the width between the copulatory openings, figs 1I–1J) (*vs*. narrow, figs 2–3 in Li *et al*. [2009]). Leg formula 1243 (2143 in *S. falciformus*).

DESCRIPTION. Male holotype (Figs 1A,C, 2B,E,H). Total length 2.16. Carapace 1.10 long, 0.89 wide; opisthosoma 1.21 long, 0.95 wide. Carapace red-brown, covered

with long sparse brown setae, glabrous posteriorly. Eye sizes and interdistances: AME 0.05, ALE 0.08, PME 0.01, PLE 0.05, AME–AME 0.08, AME–ALE 0.13, AME–PME 0.17, ALE–PLE 0.10, PME–PME 0.18, PME–PLE 0.17; MOA 0.14 long, eye area anterior width 0.17, eye area posterior width 0.20. Clypeus height 0.08. Chelicerae with 7 promarginal peg-like teeth. Endites yellow, 3 times longer than wide. Labium yellowish-brown. Sternum yellow. Legs orange-brown, covered with plumose setae, more obvious in metatarsi and tarsi (Fig. 1C). Opisthosoma orange-brown, covered with long, sparse brown setae. Leg measurements: I 2.23 (0.61, 0.67, 0.36, 0.59); II 2.19 (0.60, 0.67, 0.34, 0.58); III 1.84 (0.55, 0.60, 0.28, 0.41); IV 1.88 (0.58, 0.57, 0.29, 0.44).

Palp. Yellowish-brown. Tibia subequal in length with patella, with 2 apophyses (ventral and dorsal). Ventral apophysis spoon-shaped, coiling anticlockwise about 180°, subtruncated at distal margin, abruptly constricted at distal 1/3, with a small sub-triangular projection near distal margin, the apophysis distinctly covering the posterior margin of the bulb in ventral view (Fig. 1G), retrolateral side of the apophysis covered with several setae at proximal 1/3 (Fig. 1H), dorsal tibial apophysis not strongly extended, but wide (compared to ventral apophysis), sub-triangular distally. Cymbium covered with sparse plumose setae at dorso-prolateral half, with a sub-triangular projection adjacent to the tutaculum in retrolateral view (Figs 1G–H). Embolus falciform, wrinkled and rounded distally in ventral view, originating from 3:30 o'clock position and its tip ending at 2:30 o'clock position (Figs 1G–H).

Female, allotype (Figs 1B–D, 2F, I). Total length 2.36. Carapace 1.12 long, 0.92 wide; opisthosoma 1.36 long, 1.04 wide. Eye sizes and interdistances: AME 0.05, ALE 0.08, PME 0.01, PLE 0.07, AME–AME 0.07, AME–ALE 0.12, AME–PME 0.15, ALE–PLE 0.10, PME–PME 0.16, PME–PLE 0.19. MOA 0.15 long, front width 0.17, back width 0.19. Clypeus height 0.08. Appearance of carapace and legs as in male. Opisthosoma black brown, with some brown sub-circular spots. Leg measurements: I 2.13 (0.56, 0.61, 0.33, 0.63); II 2.12 (0.57, 0.62, 0.32, 0.61); III 1.72 (0.52, 0.56, 0.26, 0.38); IV 1.77 (0.55, 0.54, 0.29, 0.39). Epigyne (Figs 1I–J) an inverted mushroom-shape (0.55 long, 0.60 wide), raised mesally, with a transverse, sub-oval and wrinkled anterior hood, 2 gently curving copulatory openings with openings facing anteriorly and located inside fovea; copulatory openings separated by about one diameter. Copulatory ducts strongly sclerotized close to copulatory openings and slightly longer than spermathecae. Spermathecae croissant-shaped, separated by less than 1 radius. Fertilization ducts originating near mesal sides of spermathecae.

VARIATION. Intraspecific variation occurs in the ventral tibial apophysis with a small sub-triangular projection near the distal margin in some specimens, but the projection is reduced in 3 specimens.

DISTRIBUTION. China (Guangdong) (Fig. 3).

REMARKS. All specimens were collected in nests of the ant *Tetramorium insolens* (Smith, 1861) (Fig. 1E).

Discussion

According to Cushing [2012], spider-ant associations can be classified into three types: myrmecomorphous (spiders have close morphological and behavioral resemblance to ants), myrmecophilous (spiders usually live alongside the ants or within ant colonies), and myrmecophagous (spiders are specialized to prey on ants). The latter two are not mutually exclusive.



Fig. 3. Type locality of *Stiphropus myrmecophilus* sp.n.

Рис. 3. Типовое местообитание *Stiphropus myrmecophilus* sp.n.

S. myrmecophilus sp.n. can be classified as a myrmecophile or myrmecophage. All 21 specimens (18 adults and 3 juveniles) of *S. myrmecophilus* sp.n. were collected from 2 different ant nests. Some specimens were even found in the nursery of the ant nest (Figs 2A–D). The collectors didn't search for *S. myrmecophilus* sp.n. outside the ant nests, but evidence suggests that the discovery of *S. myrmecophilus* sp.n. in ant nests is typical.

Data on the biology of *Stiphropus* species are very scarce. In laboratory tests, the females of *Stiphropus* sp. from Ndumo Game Reserve (South Africa) frequently captured worker ants from the genera *Lasius*, *Messor* and *Crematogaster* [Pekar *et al*., 2018]. However, they also readily accepted termites, and to a lesser extent, some other arthropod prey, such as collembolans, dipterans, crickets, cockroaches and lepidopteran larvae [Pekar *et al*., 2018]. Unfortunately, the collectors of *S. myrmecophilus* sp.n. did not observe whether it preyed on ants (adults, pupae, eggs and larvae) or relied on other food, so we cannot determine if the new species can be classified as a myrmecophage.

Many species of Thomisidae have myrmecophagous associations with ants, which has been summarized by Cushing [2012], but none of the species in the

genus *Stiphropus* has been reported to have an association with ants in a natural environment. Thus, this new species is the first documented myrmecophilous *Stiphropus*.

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